

Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

## High mass loading porous $\text{CoNi}_2\text{S}_4$ nanosheets with ultrahigh areal capacity for flexible supercapacitors

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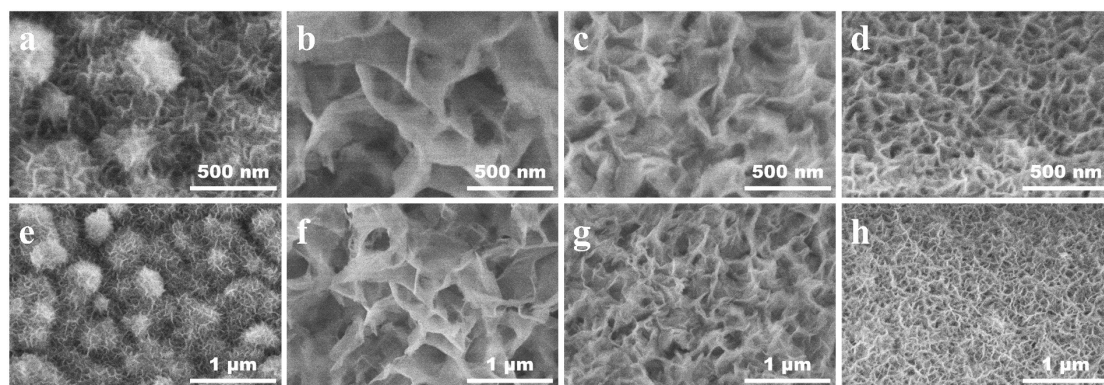


Fig. S1 FE-SEM image of (a, e) Ni-1000, (b, f) Co-1000, (c, g) NiCo2-1000 and (d, h) CoNi2-1000.

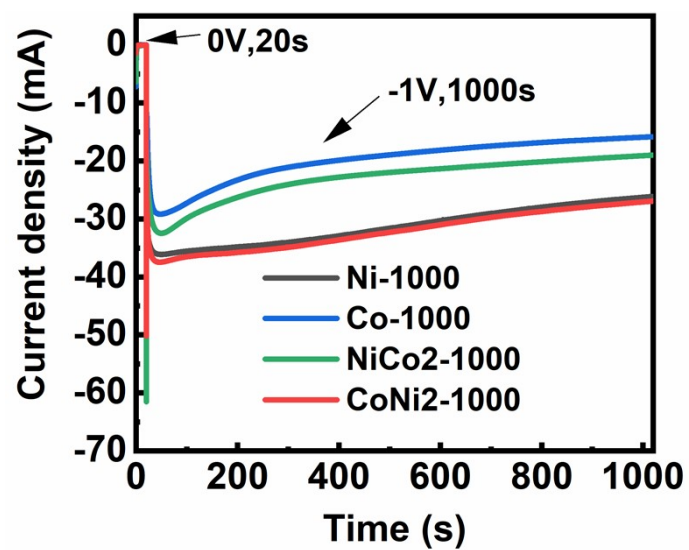


Fig. S2 The variation curve of current with time in electrodeposition process.

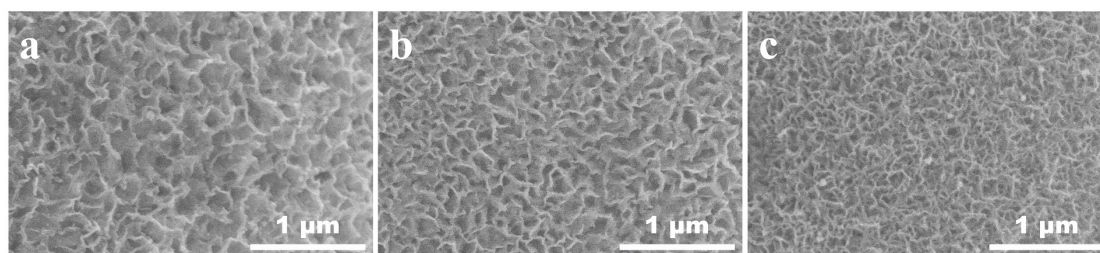
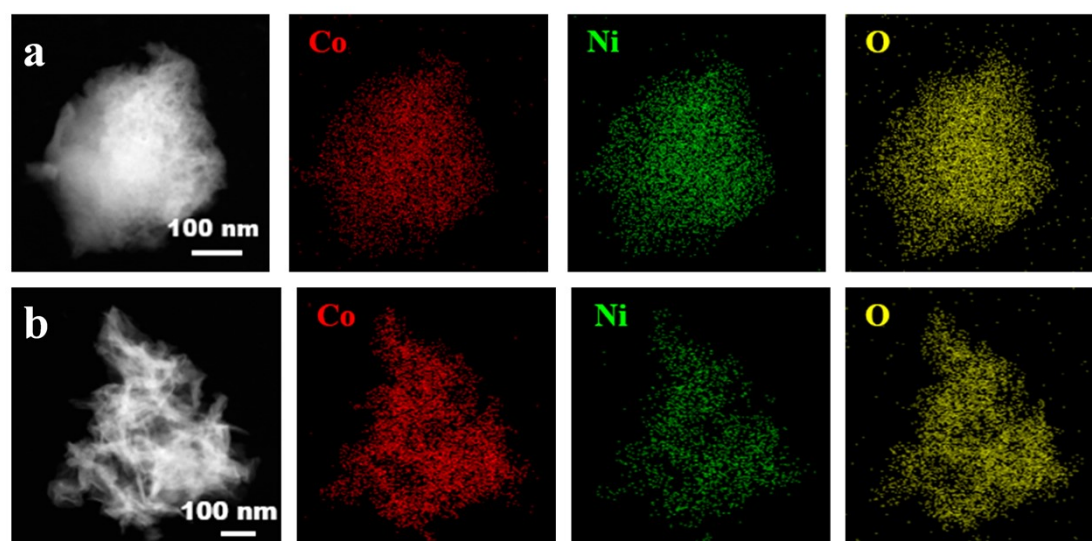
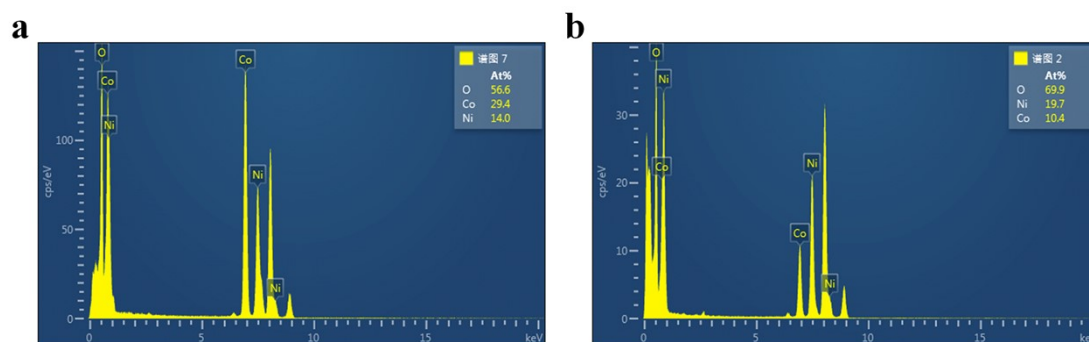


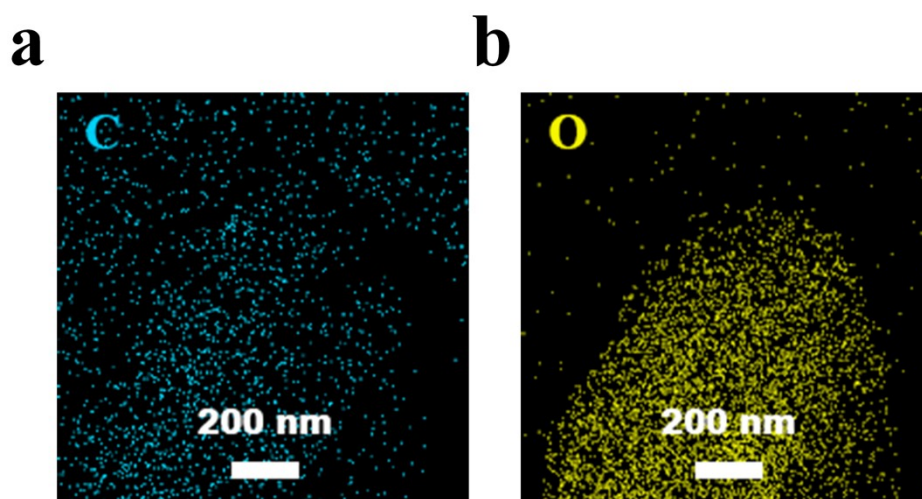
Fig. S3 FE-SEM image of (a)  $\text{CoNi}_2\text{S}_4\text{-200}$ , (b)  $\text{CoNi}_2\text{S}_4\text{-500}$  and (c)  $\text{CoNi}_2\text{S}_4\text{-1500}$ .



**Fig. S4** Elemental mappings of (a) CoNi<sub>2</sub>-1000 and (b) NiCo<sub>2</sub>-1000 for Co, Ni and O.



**Fig. S5** EDX spectrum of (a) NiCo<sub>2</sub>-1000 and (b) CoNi<sub>2</sub>-1000.



**Fig. S6** Elemental mappings of CoNi<sub>2</sub>S<sub>4</sub>-1000 for (a) C and O.

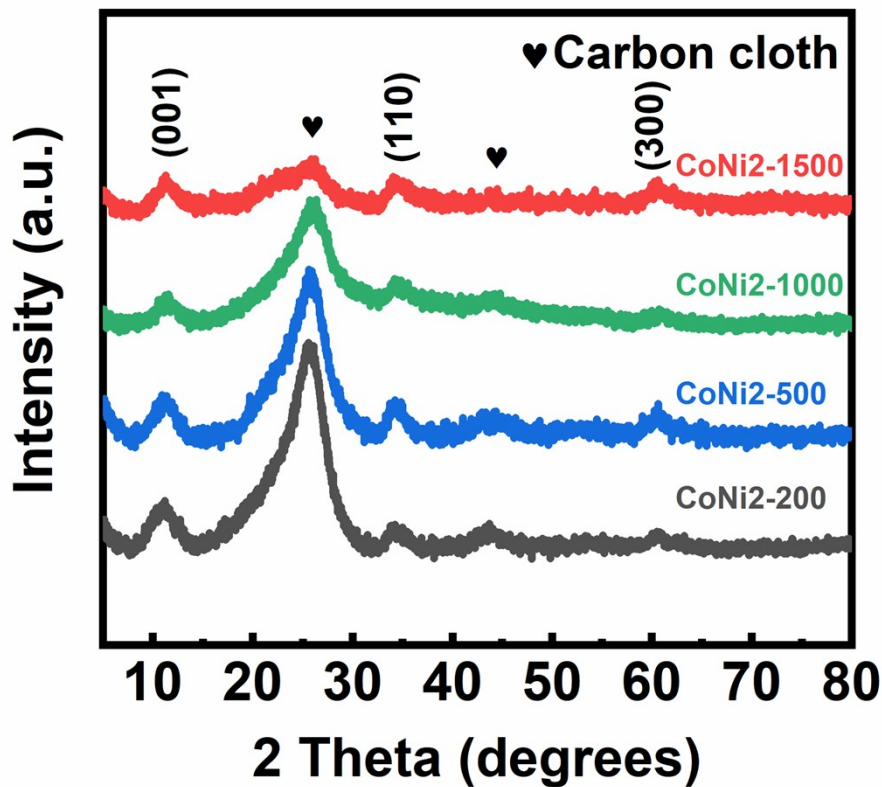


Fig. S7 XRD pattern of CoNi<sub>2</sub>-200, CoNi<sub>2</sub>-500, CoNi<sub>2</sub>-1000 and CoNi<sub>2</sub>-1500.

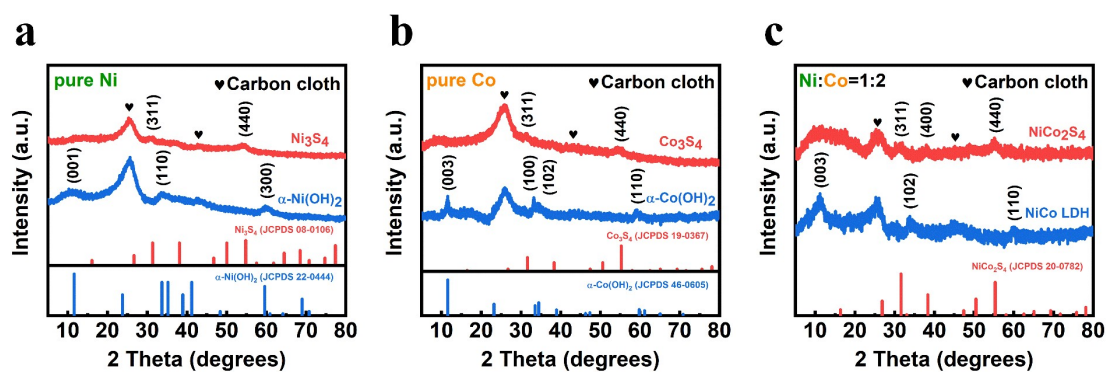


Fig. S8 XRD pattern of Ni<sub>3</sub>S<sub>4</sub>-1000, Co<sub>3</sub>S<sub>4</sub>-1000 and NiCo<sub>2</sub>S<sub>4</sub>-1000.



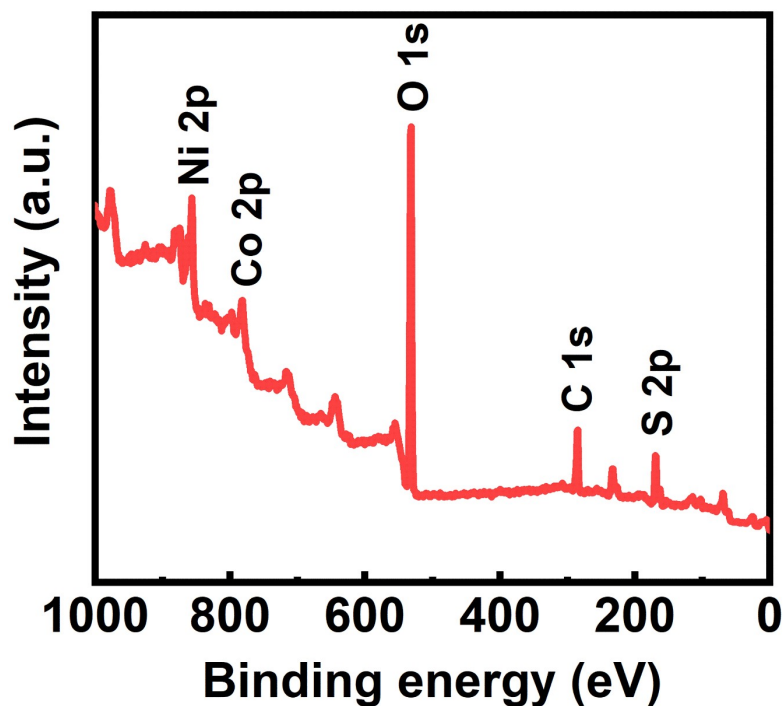


Fig. S9 XPS spectra spectrum for CoNi<sub>2</sub>S<sub>4</sub>-1000.

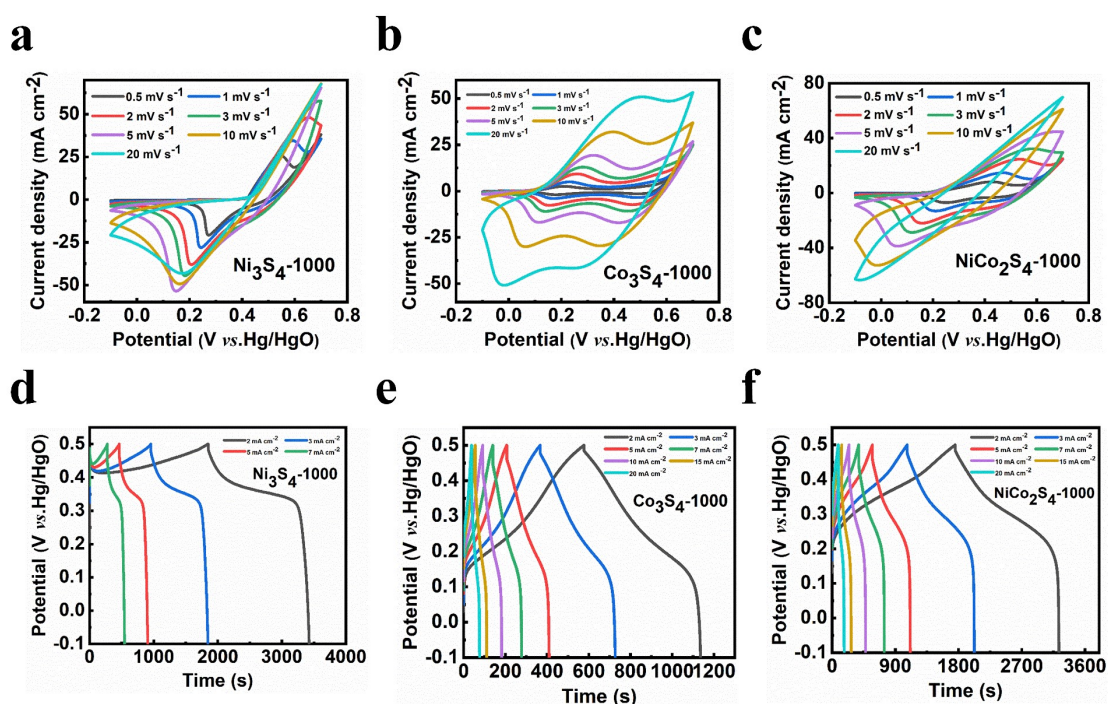
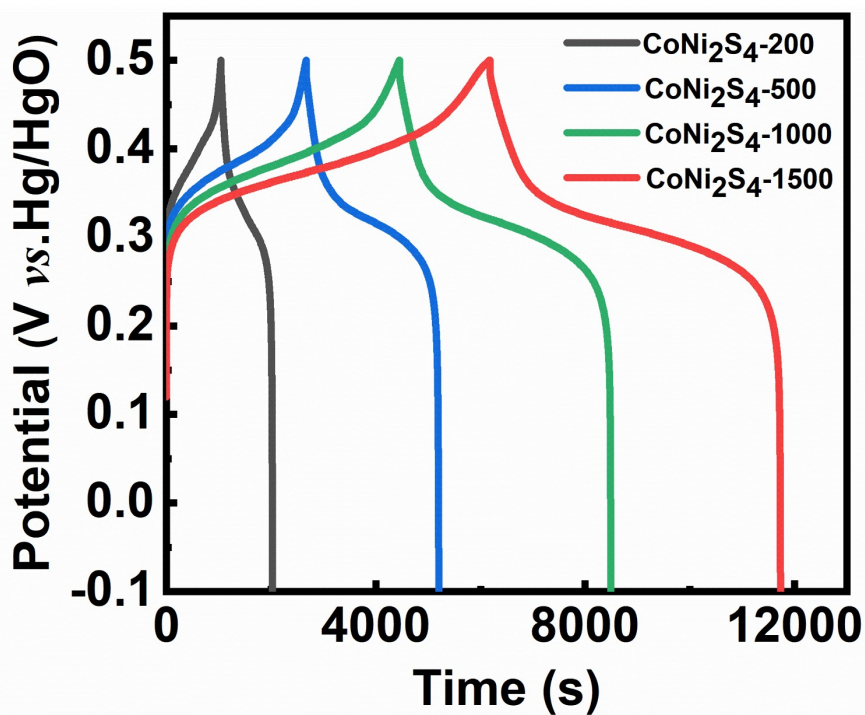
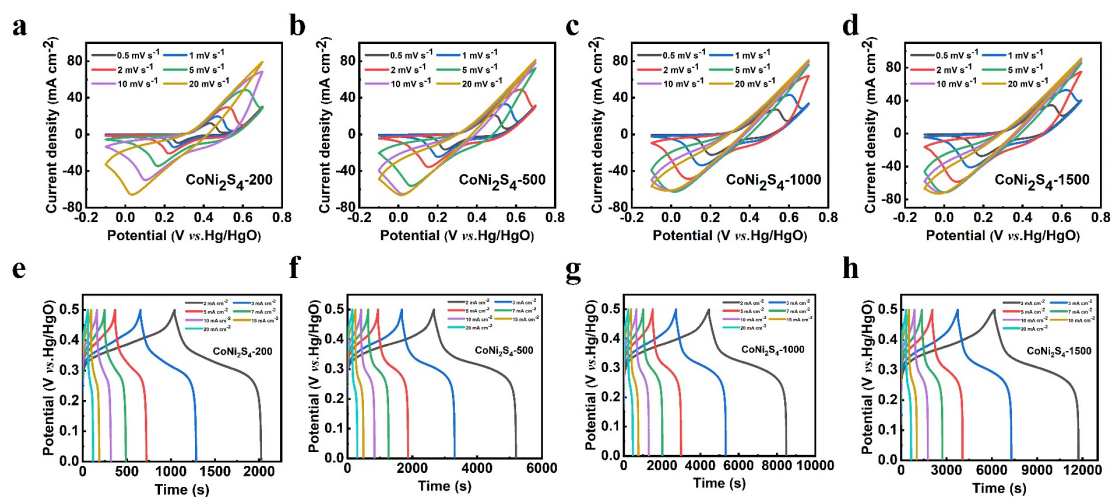


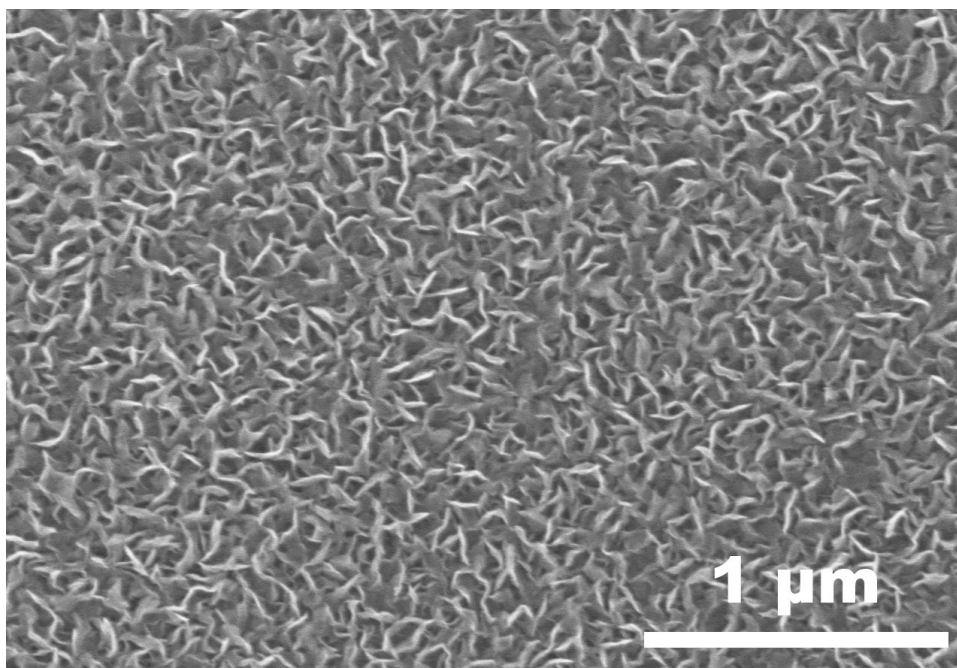
Fig. S10 CV curves of (a) Ni<sub>3</sub>S<sub>4</sub>-1000, (b) Co<sub>3</sub>S<sub>4</sub>-1000 and (c) NiCo<sub>2</sub>S<sub>4</sub>-1000 electrodes obtained at various scan rates. GCD profiles of (d) Ni<sub>3</sub>S<sub>4</sub>-1000, (e) Co<sub>3</sub>S<sub>4</sub>-1000 and (f) NiCo<sub>2</sub>S<sub>4</sub>-1000 electrodes obtained at different current densities.



**Fig. S11** GCD curves of the CoNi<sub>2</sub>S<sub>4</sub>-200, CoNi<sub>2</sub>S<sub>4</sub>-500, CoNi<sub>2</sub>S<sub>4</sub>-1000 and CoNi<sub>2</sub>S<sub>4</sub>-1500 electrodes, respectively.



**Fig. S12** CV curves of (a) CoNi<sub>2</sub>S<sub>4</sub>-200, (b) CoNi<sub>2</sub>S<sub>4</sub>-500, (c) CoNi<sub>2</sub>S<sub>4</sub>-1000 and (d) CoNi<sub>2</sub>S<sub>4</sub>-1500 electrodes obtained at various scan rates. GCD profiles of (e) CoNi<sub>2</sub>S<sub>4</sub>-200, (f) CoNi<sub>2</sub>S<sub>4</sub>-500, (g) CoNi<sub>2</sub>S<sub>4</sub>-1000 and (h) CoNi<sub>2</sub>S<sub>4</sub>-1500 electrodes obtained at different current densities.



**Fig. S13** SEM image of CoNi<sub>2</sub>S<sub>4</sub>-1500 electrode after cyclic stability test.

**Table S1** Areal capacity and gravimetric capacity of Ni<sub>3</sub>S<sub>4</sub>-1000, Co<sub>3</sub>S<sub>4</sub>-1000, NiCo<sub>2</sub>S<sub>4</sub>-1000 and CoNi<sub>2</sub>S<sub>4</sub>-1000 electrodes.

Electrode material	Ni <sub>3</sub> S <sub>4</sub> -1000	Co <sub>3</sub> S <sub>4</sub> -1000	NiCo <sub>2</sub> S <sub>4</sub> -1000	CoNi <sub>2</sub> S <sub>4</sub> -1000
Mass loading before vulcanization (mg cm <sup>-2</sup> )	13.00	8.60	9.06	13.06
Mass loading after vulcanization (mg cm <sup>-2</sup> )	11.20	8.73	9.20	13.40
Areal capacity (C cm <sup>-2</sup> )	3.16	1.12	2.96	8.08
gravimetric capacity (C g <sup>-1</sup> )	281.1	128.3	321.7	603.0

**Table S2** Comparison of the electrochemical performance of the CoNi<sub>2</sub>S<sub>4</sub>-1500 electrode with those of similar materials reported in the previous literatures.

Electrode material	Mass loading	Areal capacity	Gravimetric capacity	Capacitance retention	Ref.
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	(mg cm <sup>-2</sup> )	(C cm <sup>-2</sup> )	(C g <sup>-1</sup> )		
CoNi <sub>2</sub> S <sub>4</sub> -1500/CC	18.80	11.11	591.0	85% after 7,000 cycles at 50 mA cm <sup>-2</sup>	This work
H-NiCoSe <sub>2</sub>	7.0	-	450	92.1% after 5,000 cycles at 10 A g <sup>-1</sup>	1
NiCo <sub>2</sub> S <sub>4</sub> /CC	10.76	5.23	486	84.47% after 5,000 cycles at 40 mA cm <sup>-2</sup>	2
Ni-Co-S/CC	8.84	2.82	319	95% after 3,000 cycles at 10 A g <sup>-1</sup>	3
NiCo <sub>2</sub> S <sub>4</sub> /NF	9.984	6.49	650	92% after 1,500 cycles at 20 mA cm <sup>-2</sup>	4
Ni-decorated Co <sub>9</sub> S <sub>8</sub>	8.84	2.82	319	89% after 8,000 cycles at 10 A g <sup>-1</sup>	5
NiCo <sub>2</sub> S <sub>4</sub> @MoS <sub>2</sub> /NF	11	4.43	356.66	88.9% after 6,000 cycles at 15 mA cm <sup>-2</sup>	6
CoNi <sub>2</sub> S <sub>4</sub> /CC	14.8	10.87	734	88.8% after 5,000 cycles at 70 mA cm <sup>-2</sup>	7
NiCo <sub>2</sub> S <sub>4</sub> /NF	18.7	5.39	288	-	8
NiCo <sub>2</sub> S <sub>4</sub> /NF	6	7.91	1318.3	99% after 5,000 cycles at 50 mA cm <sup>-2</sup>	9

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